Dr

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An Inaugural Dissertation

on the

Physiology

OF THE

Brain and Nerves

By

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"Spiritus intus alit, totam que infusa per artus
Mens agitat molem, et magno se corpore miscet."

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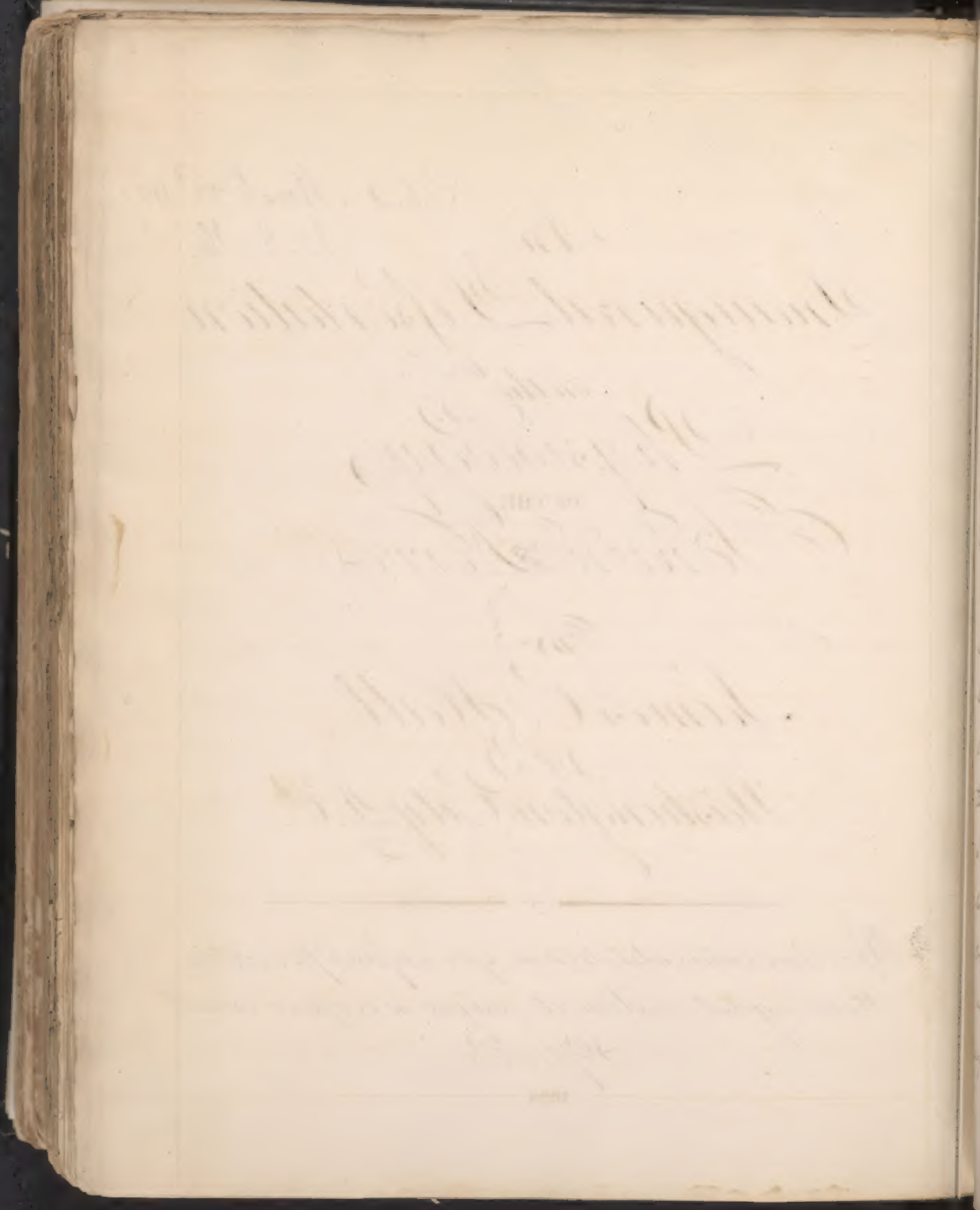

That the true Philosophy of life is only to be found in a knowledge of the Nervous Functions, is an opinion which intelligent research and ingenious experiment is rapidly advancing to the certainty of truth.

Admitting, as we must do, that in the Brain and Nerves reside the first motive and percipient principles of our system; medicine must ever remain an empiric art until a knowledge of these organs fixes the volumes of its system, and becomes the data of its practice, and science will in vain extend to nature's verge, while it confesses the humiliating truth, that we of all subjects else, are to ourselves the most unknown – It would be interesting to inquire why this noblest effort of creative skill, has so

may been hid in obscurity, or has only presented to the obscure, confused, and discordant facts.

The discussion of the Question: What is Life? has startled from their lethargic rest, the gigantic ignorance and bigotry, & has kindled the most brilliant meteors of false but ingenious science. By the former the pursuit has been charged with daring impiety and presumption, as if our corporeal structure and functions had alone violated the system of nature, or that it is as alone the Creator had dispensed with the relations of cause & effect as subservient to His designs.— But so far as nature unfolds her plans, it is their purest mutual— In the eye we see changes occurring to suit the variations of a physical agent— in our muscles the most perfect adaptation to mechanical laws, both in structure and operation; and why may we not suppose that the less obvious processes of our organs may also be the

result of the catalitic but modified properties of matter — There is no element to be found in our structure that is not furnished from the common laboratory of nature, but imbued with the new property of life, we do not expect to see it exhibit ordinary affinities.— Hence we hear it boastfully alleged by the advocates of the "vivinity of Life" that chemical laws are suspended by its influence. Be it so: but have not the catalic and ordinary affinities of a salt been changed by the mystic and invisible influence of galvanism & been made to pass the test of an acid unchanged? And as until an acquaintance with the elementary laws of matter is more accurate, it must be said that it is not by some undefined agency of the same powers, that we have our Evaporation, Affinitation & Temperation functions. Dr Godman has said that— The laws of life place the materials in a proper relation, and

the laws of affinity combine them together."†

But if ignorance and contracted views have retarded investigation into the nature and laws of the vital principle, by at once referring all its operations to some preternatural and inscrutable cause, why have the efforts of men of science been equally unavailing.— It is because the observation of facts, and the recurring of experiment have been neglected.— But entwined with laboriously ascending link by link in the long-twined chain of causation, they have exhausted their intellect in aspiring to comprehend the ultimate nature of mind and matter — They have overlooked the "matter of fact, by attending solely to the manner of the fact — Hence have originated the ideas of ethereal Essences, vital Spirits &c. — And we see them

† Article 3d Vol S. Phil. Med. Journal

from something new, a sneer, and remain desirous its introduction to the scientific world with all the attributes of an actual science. Comparing the Phrenology of Gall ... the weights of Brains, of which it, among other sciences, had been demonstrated and assumed as true, much more will be afforded with names of such men as Cuvier, Magendie, Pritchard & Bell.

The Brain and its dependencies are indicated to be the most essential animal organization by the extreme care with which they are ~~enclosed~~ guarded from external injury or internal derangement — the admirable in-terstices of the cranial and facial bones unite strength with the requisite lightness: while the elastic [illegible] to the requisite texture, the cranial mass an equable support. Cuvier says that in some animals that in fact the intervening spaces,

[illegible]
[illegible]
[illegible]
[illegible] Tall? of functions and know nothing are ignorant of the finer structure of the brain. All agree that its minute structure is singularly curious, and most probably essentially connected with the function of the organ?.

Development. — That there exists in the embryo, a perfect representation of the future animal, is an opinion that modern physiology has abandoned, & in its place advanced the idea that all the parts are reciprocally formed, and increase in complication & approach to perfection, as they remove from their most simple element, and assume a higher grade of organization — Thus in ~~man~~ the first rudiments of man we will discover the germs of its nervous system, but at this time corresponding to the perfect development of some inferior order.

"Let us" says M. Serres, "go back to the uterine life of the mammiferous: you will perceive at first the cerebral hemispheres divided as a sickle into two series separated from each other. After a time, you will see them affect the configuration of the cerebral hemispheres of reptiles; at a later period again, they will exhibit to you the appearance of those of birds; and finally, it is only at the epoch of their birth, and sometimes later, that they acquire the permanent form which the adult presents in the mammiferous".

To the same ingenious and philosophic author we must be indebted for what we shall say in other part of the subject — An "Eccentric Development" is observed in the formation of all the parts of an animal body — Every part will be evidently formed & isolated in its situation — Each part will [illegible] the law of [illegible] "and in the [illegible] will approach and unite at the [illegible] line of the law of conjunction — [illegible]

[illegible] existence — They conceive that all the ner-
vous systems are [illegible] as in the vertebrated
animals &c — Dr. [illegible] has [illegible] thought
that the fibres of muscles the surface of the skin &
other secreting parts may possibly require something like
a portion of neural matter — Gall & Sp. suppose the
cortical matter to be the end of the nerves & its
quantity is always proportionate to the trunks arising
there from and it is always to be found in the ori-
gin of the nerves — Dr. G. produces as many particular
systems as he finds ganglions and these are [illegible]
[illegible] the [illegible] [illegible] [illegible] their func-
tions — The [illegible] spinalis is divided in a chain of gan-
glions in the caterpillar, and the same remains and
in the undulated appearance of that, in the mam-
malia — The anterior and posterior filaments of the spinal nerves
emanate from the ends of the internal [illegible] of the cor-
tical matter, and are always proportionate to the swel-
ling of the ganglions whence they arise — The medulla

oblongata, since this last, contains the ganglionic centres of grey nervous substance, and gives origin to most of the nerves of the senses — An elementary cord rises from within the M. O., ascends to and the cerebellum, and [illegible] into a [illegible] body called the Corpus Dentatum; whence a radiated band of medullary fibres are dispersed in a [illegible] manner to the periphery of the cerebellum, [illegible] of this [illegible] — The [illegible] [illegible] the cerebellum [illegible] a transverse section presents.

After the Corpus [illegible] has [illegible] the medulla oblongata [illegible] the [illegible]; fibres [illegible] contracts & [illegible], and enter the [illegible], whence they [illegible] additions of grey matter, [illegible] from the [illegible] posterior [illegible] of the M.E. — Thus [illegible] the pyramidal and [illegible] [illegible]

striata, and optic thalami — Enlarged in these bodies
they expand their fibres to the whole periphery of
the brain — beyond the space in which rest the
base of the convolutions there is a peculiar ner-
vous matter — This tho' at first in layers forms more
interiorly distinct ~~layers~~ fasciculi, which converg-
until they meet their fellows of the opposite side, and
either by a simple juxta-position, or interlacing of
the fibres thus form all the commissures —
The ventricles of the brain are formed by the op-
posing layers of the converging and diverging
fibres — Each convolution consists of ~~a layer~~ the
duplicature of a layer of the medullary matter, whose
external surface is clothed with a layer of cortical
matter; and this is made evident by the move-
ment of some distending fluid as in hydrocepha-
lus to be an artificial unfolding — The more nu-
merous [illegible] of [illegible] in higher intelligence
[illegible] the parts of the [illegible] structure of the

brain are shewn to concur in a connected and uniform design, and are not the result of a necessity of fortuitous arrangement as some have supposed - Also, the idea is rendered probable of the existence of independent nervous systems or organs, by which alone can all the varied and continued operations of life and intellect be explained. So novel & unexpected are the discoveries of [illegible] that it [illegible] for their reputation that this [illegible] under the concurrence of such men as Tiedemann Sömmering & Lamarck.

The nerves are divided into those of animal life and those of organic - The first by Bichat are derived from the brain & the spinal marrow; the last from the ganglions, but the accuracy of this division is not allowed - The pairs of animal life are mainly symmetrical - Their primitive fibrils spreading into the form of filaments, and then of chords, [illegible] then [illegible] invested with a sheath of the

dura mater which lines itself in the pericranium cell-
ular texture – The pia mater takes the form of small
canals in which is contained the nervous medulla –
These are the nerves' continuance, and form plexuses
in which the different nerves are so mingled that
the branches cannot be traced to any of the primitive
chords – The filaments in the interior of the chords also
communicate, but similar as contiguity, and this cor-
roborates the idea of each filament being in a distinct con-
veyance – What may be the ultimate structure and dis-
tribution of the nerves is still unknown but it is thought
that they ultimately lose their investing membrane, and
only allow their medulla to penetrate the various structures.
M. Bogros is said not only to have injected the neuri-
lematic tubes but also to have proved the medulla itself
tubular – After having removed the neurilema, he was
able to pass mercury thro' the medullary fibril.
The nervous fluid which seems from the experiments of
Reil to act as a stimulant: and there is little doubt

that the medulla is the result of a secretion and not an emana-
ation from the brain since in the latter case, the [illegible] for-
tion of a nerve ([illegible]) would require [illegible] which is not
the case — Hence when [illegible] section [illegible] tissue appears
to resemble such cellular substance; a fact perfectly anal-
ogous to other secretory structures. —
How do the Cerebral & Nervous System commence their
functions? — [illegible] the action of the
lungs and circulation of the red blood is requisite to the
functions of the brain and the skin; the former is depen-
dant upon an influence derived from the latter in man
because when is this circle of functions [illegible]
[illegible] — He alludes to a "[illegible]
"excitement — that the brain experiences from the skin's
"mucous surfaces which the external air acts upon",
and "the lungs and the brain influence each other recip-
rocally at this period the first is sending red blood to
the [illegible] and this by putting in action the diaphragm
and the intercostal muscles, which make the air that

is necessary in the production of this red blood penetrate the lungs." Thus we strangely exhibit the lungs executing their function 'ere the diaphragm & the intercostals are in action — Dr Hopkinson in his Inaugural Essay on the Nervous Functions observes that the child never attempts to breathe until the face is exposed to the contact of the atmosphere — He asks if this may not be attributed to the action of the cold air upon the respiratory nerve of the face (the portio dura) which conveys this action to the brain and sets the whole respiratory apparatus in motion — Here the portio dura is not a nerve of sensibility, according to Mr Bell's & Dr [illegible] experiments and in addition to this, the connected nerves, as the spinal accessory, & superior respiration are contributed to the [illegible] nerves and cannot equally feel the influence of the stimulating atmosphere with the respiratory nerve of the face — Besides this it is inconceivable that a nerve so this time could commence in action when the nerve whence

it derives ~~its~~ power, is at this time totally inoperative – One should rather suppose that all the muscles of respiration, those of the glottis as well as the thoracic receive a shock (or temporary excitement) from the stimulus of external agents, by which the first motions of respiration are performed – The efficacy of the means resorted to in cases of accidental asphyxia, and of delayed respiration at birth, strongly corroborate this explanation

– It is not known that the nerves in their development in the foetus are not proportioned to the parts they supply, Their nervous [illegible] have little effect ~~they~~ [illegible] in nutrition – This may apply to the foetal state but not [illegible] to the independent existence – [illegible] is derived from the mother a principle [illegible] the nervous agency, either [illegible] diffused thro' the blood, or otherwise bestowed – There must have been a time when the [illegible] derived it [illegible] [illegible] [illegible] [illegible] [illegible] not the same [illegible] [illegible]. Tho'

the whole term of gestation is not as in the incu-
bate — The existence of gestation coincides with the ova-
rial & placental organs [illegible] such impregna-
tion necessary —

During the foetal state are the brain [illegible] [illegible]?
[illegible] says that the brain is then in the operation
of action but that its activity is an incapacitating one,
& its organization not complete nature is at variety of
gestation and in the [illegible] of its head & [illegible]
[illegible] to its action we are at liberty to ~~suppose~~ [illegible] that
its functions are this period is one requisite for the purpo-
ses of organic life, and [illegible] it [illegible] compacts with the
[illegible] of the [illegible] to suppose ~~that~~ the sensibilities
of animal life are not then existent — But organs
with the requisite [illegible] and [illegible] capable of [illegible]
[illegible] this [illegible] would be its existence in the dark
[illegible] [illegible] [illegible] [illegible] would be [illegible]
in the time of birth — Rather than we to suppose that
the exercise of its functions is kindly [illegible] [illegible]

the proper field for their action is afforded.—
In Infancy the sensations are vivid and consumption bespeaks the vivacity of the sensations — Organic and functional disease of the nervous system predominate at this period — In adult age the powers of reflection gain the ascendancy, and the senses are more the means of instruction, than of pleasure, no longer as in infancy experiencing delight from consumption[?] — Old Age exhibits the senses impaired, the brain and nerves much firmer, darker & less enriched with blood: and who will not think that these appearances are connected with the feebleness of mind, the cessation of pleasure, and the insensibility to pain, so characteristic of this age.

Nervous Functions —

Having thus given the descriptive anatomy of the brain and nerves, we proceed to describe the offices they perform — The functions of the cerebral system may be divided into Animal & Organic.—

Under the first should be enumerated those having a relation to the Intellect, – Sensation, Volition & Locomotion – Under the last all those Functions that assist in the grand operations of Nutrition, Calorification and vital preservation – Dr Wilson Philip divides the Functions into Sensorial, Nervous and Muscular – The First are the result of vital parts affecting each other by their vital properties – The two last the result of inanimate parts acting upon vital parts. –

It is a question of interest and importance whether particular parts of the brain are appropriated to particular Functions and whether the powers of the ~~[illegible]~~ various organs are dependent on their relative quantities as they are in external form & dimension – The older Philosophers amused themselves with appropriating to different parts the distinction of being the immediate residence of the soul – The pineal gland the corpus callosum, the Cavities of the ventricles have all been

concerned with the reflection — Haller supposes the soul to reside in all the medulla — Locke in the Ventricles, where the nerves meet: but the attempt is idle. We may find the organs mediating between the mind and its objects, but its own immediate location is an inscrutable mystery. The organs of the intellectual and moral faculties have by G. & S. been supposed to ~~unite~~, have their base in the circumference while their apex terminates at some undiscovered internal point. To this it has been objected that large portions of the brain have been removed without a corresponding injury to the intellect; but can we assert that the whole of an organ essential to a faculty has been removed — These organs are also double, and besides, were all the various powers of the mind dependant equally upon the integrity of all parts of the brain, it would be easier to discover the failure of all the faculties, rather than the injury of an individual one — Sir E. Home has suggested that we may derive important conclu-

sions by comparing the results of injuries to this organ variously inflicted and treated. — We give a number of instances. The meditations Historiæ of Lancisy, Hennen & Hughes are curious on this point & would have been much more so, had their attention been directed to its physiological bearing. Loss of the generative faculty and atrophy of the testes followed a sabre wound, which cut off the external pudendum of the occipital bone. — A Portuguese soldier, complained to Staff-Surgeon Hughes that a shell which had taken off a large part of the occipital bone had completely ruined his virility ever after. A blunt weapon was traced to the effusion of four drachms of coagulable blood beneath the edge of the tentorium. Loss of memory followed an injury of the frontal and parietal bones. In another case the power of distinguishing objects was lost while memory remained. An injury of the parietal bone near the frontal

occasioned the entire loss of speech. A soldier wounded in the head forgot his own language and learned another: and a case is familiar to all, where a woman from a wound of the head, was made to speak Welsh tho she had not done this for 20 years.

From all these cases we are taught that individual faculties may be totally lost by partial injuries, while the other faculties may retain their full force.

What other inferences can be drawn but that the mind manifests itself thro' individual organs, and is itself composed of various, and in a measure, distinct powers — The parts of the brain to which the nerves of sense are traced are indispensable to the performance of their functions — The tubercula quadrigemina whence the optic nerves arise have been found diseased when the sight was lost — A tumour in the tuberculum mammillare & water in the ventricles caused the loss of sight in one eye; dullness of hearing & difficulty of swallowing, so as to cause starvation with

all the mental faculties intire — In a case where the tub. annulare had become extremely hardened, and the cerebellum & cerebrum much softened, the effects were that the boy was always an idiot, never walked, spoke or understood what was said — Here evidently the effects might be traced to the injury of the reflection & sentient organs.

Experiments were performed to show the part that the different organs bear in the animal economy — M. Flourens found that in proportion as he sliced off the cerebellum the animal became weak & unsteady in its motions, which at last were totally failed, while perception & sensation remained: when he took out the cerebral lobes, memory, hearing, vision & will were extinguished tho the power of voluntary motion remained — The optic thalami, the crura cerebri & the tubercula quadrigemina have important relation to motion since in slicing the brain the operation proceeds with impunity, until it reaches these parts — Magendie observed that a wound of the cerebellum destroyed the power of progression: he says it

back upon which I removed a small part of the Cerebellum, could swim backwards, but made no progressive movement in right lines. —— Certain substances the stomach seem to produce their effects upon specific parts of the Brain – Those celebrated & accurate experiments Flourens has determined that sleep arises exclusively upon the cerebral lobes – belladonna upon the Cor.a quad.a and alcohol, camphor & ether upon the Cerebellum, and the functions of these lobes acted upon seem to be those alone affected. –

Messrs Bell, Magendie, & others have made some very curious discoveries with regard to the spinal marrow – Mr Bell has shown that there are two anterior chords connected with the cerebral lobes or nerves, & going right to the nerves of motion: and that there are two posterior chords connected with the cerebellar nerves, and appropriated to the nerves of sensation which there are intermediate chords which stop short at the med.a obl.a and are the source of the respiratory

nerves. — The accuracy of this division is tested by various experiments, and by (many) pathological facts. — Irritating the posterior fasciculi of nerves increases their sensibility, while the irritation of the anterior creates spasmodic action of the muscles — The corpora olivaria & pyramidalia & viscera, with the whole anterior part of the spinal marrow were found diseased in a man, who had for years labored under paraplegia, but had retained the sensibility to the last moment — M. Foderé a German surgeon of Paris, has observed the same coincidences of morbid appearances, with similar affections in a horse — There is some confusion from the deductions of the experiments of M. Bellingeri, who thinks himself authorized to attribute to the posterior columns of the Sp. Ma. the powers of sensation & extension of the limbs, but to the anterior, flexion alone. It is difficult to reconcile these opposing experiments except on supposing that the irritation of compression on the posterior fasciculi, extended, partially to the anterior

We have now considered how the Functions are modified by a difference in the sensible properties of the nerves. Nature has been said to be sparing in causes but profuse in effects. This is true but tho we admit the primitive unity of the vital & nervous principle, yet we cannot doubt but that it operates in producing distinct effects by appropriate & distinct means. The older physiologists concluded that three very different functions sensation and motion were effected thro' me & the same organ. This would be a most erroneous, not only by the incompatibility of these functions, but by the variety in the physical properties of the nerves themselves. Physical, and the internal arrangement of different nerves is known to vary but that also they are dissimilar in the colour and consistency of their medulla. This is particularly observable in the nerves of the senses. Hence Wichot concludes that the "optic nerve would be unfit to transmit tastes, the auditory to propagate impressions made by light." — Confirming by ample experiment the fact that each

filament has a peculiar endowment. Bell & Magendie have classified the nerves into three. 1st those of sensation. 2nd those of voluntary motion 3rd those of respiratory motion or those that unite all parts of the body in unity of feeling & action. — We are loth to believe that this division extends so far, & are disposed to think that future investigation will add some new ones to these. In any nerve many different functions are combined, and it seems that the ordinary [illegible] in [illegible] — the trigeminus is a nerve in which the filaments of sensibility & voluntary motion are united. The irritation of its sup. max. branch gives acute pain & its division in [illegible] muscles of the face are concerned in the ~~[illegible]~~ actions of respiration. The portio dura & branches of par vagum produce a necessary concert of the muscles of respiration with those of respiration — its division occasions little pain, but the respiratory action of the eye & face are gone and then only remains a hideous & [illegible] point! These instances [illegible]

ficient to insure the accuracy that practical medicine may, in some instances. The alarming paralysis which has its seat in the brain may be distinguished from that which arises simply from the disordance of the respiratory muscles: and we thus so perfectly understand the admirable precision & effect with which respiration & expression are accommodated, in all the wonderful operations of the human voice, from the loud tones of command to the impassioned charts of tragedy and oration. —

We now comprehend how the functions of certain filaments may become impaired, without vitiating functions depending upon other filaments — Thus Hemiplegia exists frequently without any corresponding injury to the functions of mastication & respiration. The sensibility remains in the hands, when the palsy has impaired the muscles — The tongue becomes paralysed without any defecting the gustatory function and Dr Abercrombie relates the case of a man who lost the power of articulation tho he retained his control over all

the muscles of the larynx and face: here the muscles of voice and respiration had lost their requisite consent of action.

Why does an injury of the brain affect the nerves on the opposite side — Jones says the exceptions to this are rare — The nerves of motion are more frequently affected than those of sensation (Bichat). The union of the optic nerves seemed to infer a decussation of their fibres, but the pathological facts were extremely contradictory on this point — These seem now to be adjusted by the observation of Wollaston on the semi-decussation of these nerves and Dr. J. Crampton has recently published an illustrative case where a hemiplegia of the left side was attended with the total loss of sight ~~on the~~ in the _right_ half of each retina; consequently by the inversion of objects she only saw those objects that were on the right side of a middle line. Some have alleged that the nerves of motion decussate in the spinal cord, but this is disproved by the experiment of Galen in which

is found that a very tedious inversion of the spinal mar-
row did not occur in proportion of the [illegible] Gall
& [illegible] declare their opinion to be that these phenomena
arise from the decussation of the fibres forming the
corp. pyramidalia and in this opinion many of the modern
physiologists coincide.—

There is no visible action of the brain that seems to attest
to its function – two motions have been observed one syn-
chronous with the systole & diastole of the heart & the other
synchronous with respiration — this latter has by [illegible]
been denied, but his experiments are evidently
erroneous as he [illegible] the brain [illegible] when a [illegible]
part of the cranium had been removed — we adopt the ex-
planation of Lorry, who ascribes it to the compression
by the lungs and [illegible] of the thorax upon the veins
and during expiration when a [illegible] takes
place that depends itself principally towards the veins
[illegible] — During inspiration the reverse [illegible]
of this circulation

What effect has the blood upon the Brain? Is it simply by its irritating motion, and distending power, or by the infusion of some spiritual and vivifying principle. We think that it is in the latter — Large portions of the cranium & brain have been removed without producing syncope & here the distention of the blood must have been in a great degree diminished, while on the other hand sanguineous & serous effusions, & the venous congestion of apoplexy do not produce that elevation of cerebral function which an influx of arterial blood is observed to do. — Sir E. Home believes that Syncope ~~takes~~ is the consequence of the pressure to which the cerebrum has been accustomed being suddenly taken off. But Syncope does not take place always when large portions of the cranium have been removed — The explanation of the Brain simply requiring distention is too mechanical & coarse. Why has nature been so careful to attend to all the first & last results of the pulmonary action, and that too in the proportion of 1/5 of the whole product of a [illegible]

pressure is his only object — With Cullen we must believe the brain to be a secretory, glandular, and that, from the blood it exacts some necessary and important principle. All, must have been conscious of the vivacity of thought and elevation of spirits, following the operation of an universal stimulus; and all, must have witnessed the excitement of pulse and brilliancy of eye, that attends the animating effect of the gifted nature; and thus by this we have an explanation of the fact so mysterious to many, why the eagle, sparkling, flashing eye has probably become the indication of genius, and the almost peculiar attribute of the poet, orator, & painter — The explanation is that as a local arterial fulness of the brain, and the possession of such mental energy are frequently concomitant circumstances; the eye deriving its blood from the brain, and in common with it experiences that quick, irritation and fulness of its vessels, that gives to it clearness, brilliancy & fire — they are coincident effects from the same cause.

We now come to the consideration of the nature of the nervous principle, & the mode of its agency in sustaining the vital functions. We see in animals two indispensable powers, sensation & motion, and tho' the former principle of the one, and the animating cause of the other be insensible yet as they are both manifested thro' the medium of organization, their operation must be recorded by a reference to physical laws. — These two powers relate to external existence, and either act upon, or receive impressions from external objects, with which they can only communicate thro' the medium of the senses. Sensation is exercised & and all the purposes and functions of this life are the creation and preservation of the various parts that concur in the exercise of these two great animal prospectives — Our intention now is, to consider what agency the nerves have in this process of organization.

The animalization of matter has by different writers been referred to a principle, variously named: by the Greeks - ψυχη: by the Latins - anima: by Hippocrates - ἐμφυτον θερμον: by Hunter - the materia vitæ diffusa

by the English- the word. — This last term has been peculiarly unfortunate by leading men to confound with an intellectual nature & immortal existence those perishable qualities which seem to become incorporate with matter, and to partake of its changes — The soul and principle of vitality, tho' no doubt intimately connected, should never be considered as necessarily or inseparably identified. — The one may languish and be expunged with disease, while the other exists unchanged, amid the decomposition of its mortal tenement — The one in brute animals exists a corporeal structure, equal as superior to that of man, while the other, is but feeble, diminutive existence — In vegetable life we see a near approach to the perfection of the one, but not the slightest trace of the other - and finally the one ascends from an existence almost equivocal to its highest perfection, while the other is the noble distinction of man alone — May then I say the thinking & intellectual principle of man, be so [illegible] united with that which, besides the nutritive &

process of organization — On this subject, we cannot in this place give "all the opinions" which as Dr Barclay says "have been repeatedly published before — have repeatedly been obsolete — been repeatedly revived — and repeatedly become obsolete again"

We will define the terms used — By vital properties we understand that principle ~~that~~ which is communicated to matter in certain states, and induces it to assume organization — By function, we mean the action of matter organized, & possessed of vital properties, and by life we simply designate that state of being in which the functions are in action, or have the capacity of acting.

Two modes have been variously advocated to explain the vital phenomena — The one is certain agency of the materials of our structure — the other supposes them a distinct principle unallied to & independent of the principles of matter — the third class, make vital things the result of an organization which results from the concurrence

of atoms, brought together under proper circumstances of temperature, proportion &c — As illustrations they adduce the phenomena of the egg; the fermentation of infusorial animals and the production of animalcules by the electrical [illegible] — Since in these cases they were merely as a circumstance also that at the commencement — Opinions [illegible] of a [illegible] of these opinions and discussions their ingenious and elaborate [illegible] — It is needless to expatiate on [illegible] of these opinions — Admitting with them that the vital principle is a product and not the cause of organization it is sufficient to ask then how a [illegible] of combinations of atoms could so arrange themselves as to form a structure so admirably adapted to all the functions of Life — To avoid this some have been driven to conclude that the eyes [illegible] got their own uses, and were not designed for their many functions [illegible] — [illegible] should avoid the error of supposing that the eyes were made after the [illegible]

will" – The most eminent of the supporters of materialism in modern days have been Blumenbach, Cabanis, [illegible] & Lawrence – They all speak of the vital properties & vital forces &c and they admit of no other inference, but that matter organizes itself by its own inherent properties.

We now shall notice those who have advocated the existence of a living principle distinct from the body. Aristotle believed in the existence of a supreme animating principle possessed of intelligence, and directing the formation of bodies – Harvey believed in a principle of the same kind, but under the immediate superintendence of the Creator – Hunter believed that it is a principle, pervading all the solids and fluids but principally the [illegible] & blood, and which, if it be not intelligent, he thought was something analogous.

We think no one can doubt the existence of this principle, ~~nor that it~~ and that it is [illegible] very distinct from intelligence & instinct, but from

in their activities also — we shall not identify it with chemical affinity, because their laws are different and incompatible — Being invisible and intangible we can not describe it, but we may in some degree to form a notion of its operations, and this is all that the wisest philosopher pretends to assert in [illegible] where the operation is only seen but that there is a cause for this, not a material cause we must believe — to believe that the vital principle was originally bestowed upon certain forms of matter in a state of organization and with the means of perpetuating itself by its generation. — From the Mosaic account of the Creation we are entitled to believe that not only animals but all vegetable life was at once advanced to the perfection of their natures and as this was the first so was it the last instance of complete existence ab initio. — Since then both animals and vegetables in the form at first of seeds or germs are the result of a creative action in certain more perfect existences, to whose peculiar natures they

occasionally are seen – They, from their parent stock receive the first impulse of the vital principle, and are supported by this parent till they arrive at a certain degree of development. and are then dismissed into an independent existence, but, supplied with organs whose sole object is, to bring external ~~matter~~ and dead matter into the sphere of that principle of their nature which can confer organization – this principle we believe supports our system, and is itself perpetuated by the action of organs – viz, in a peculiar fluid – the blood – and peculiar fibres – the nervous, every where present, and essential to the life of every part – The first is matter in the first state of vitality and merely awaiting the influence of the last to assume all the properties of living substance – The particles in the composition of this fluid have not in themselves any inherent qualities similar to those of living particles, but when they are brought in the course of these living particles they receive from

their new properties, the analogy existing with them are said to be organized — what is this but affinity call it chemical, vital or what you please — that tissues when so formed are admirably adapted to noble functions does not change the nature of the action — The same power that would direct affinities to the formation of a chrystal, could equally direct them to these purposes, or restrain their irregular action — All the operations of life are influenced by outside causes, continue in invariable and unalterable course of action. Is this like the irregular action of a thinking & intelligent principle in which some would ascribe it to volition? — Every particle of matter in our bodies becomes equally the seat of this vital principle, and to say that it cannot become the property of matter because it did not accompany it while in dead matter does not invalidate the opinion — Every one ~~[illegible]~~ discriminates between the accidental and essential qualities of matter, and electricity as heat & other

substances for aught we know, are [illegible] the accidental but tremendously efficient adherents to matter — Is this vital principle one and indivisible, and does it exist ~~[illegible]~~ eternally the same, unimpaired & untiring? Is it exhausted of the same powers when it animates the feeble frame of infancy, as when it nerves the sturdy muscle of manhood? Rather let us suppose that it is generated to the precise degree that organization may require — Nor is its existence in any part dependent on the existence of a chain of communication with the central organ, where [illegible] a drop of blood would cause its function to be the animation of some powerful & spiritual agent —

The vital principle of vegetables is nearly allied to that of animals — some even show sensibility — many of them healthy functions and morbid affections resemble those of animals — They have no internal absorption, and hence the product of germination in them is permanent — The experiments & deductions of Mr.

bitter & in [illegible] alcohol; but there is a great - some
point where properties are very similar to those of
nerves - They are then termed the nerve a [illegible] of
[illegible]. —
If the sensible qualities of this vital principle of nerves
be known in these certain [illegible] it is not necessary that we
should identify it with any known chemical sub-
stance but the experiments of Philip & others tend
to show that by a chemical & natural agent
its operations may be very exactly imitated. —
Galen thought that there was an animal spirit
issued by the heart and arteries were eventually
elaborated in the ventricles of the brain and that this
was the proper instrument of the soul - as its pow-
er was otherwise united and ably supplied - Boer-
haave conceded to many of these views - says that there
must be a subtle invisible and impalpable nervous
fluid in the nerves, but since substantial [illegible]
[illegible], as it could not be confined in tubes -

in its
innervation he says. "Manifestum de cibo pasci et sine [illegible] queat" — Descartes, Boerhaave, Monro, Richerand and others contend for a fluid passing thro' the nerves. [illegible] [illegible] [illegible] we learn that Hunter conceived it to be some subtile, mobile, invisible substance superadded to inert matter — Mr Lawrence who seems to treat Hunter's opinion [illegible] in this [illegible] [illegible] [illegible]. "Why does the irritability of a muscle need such an explanation, more than ~~the~~ electric ~~[illegible]~~ attraction of a stick"? — Unfortunately for Mr Lawrence's comparison he [illegible] [illegible] to see that the electric [illegible] [illegible] [illegible] [illegible] been such an invisible fluid —

Richerand, Galen & others think that this fluid is generated — the nerves [illegible] with the [illegible] existence this fluid may [illegible] [illegible] [illegible] analogy discovered between it and the Galvanic fluid which has of late attracted much attention — Dr Galvani after he supposed that muscular contractions [illegible]

be produced by this agent and that animals had the power of thus thought of generating it from the air — Dr Good says that "it is almost reduced to a certainty that this common aura constitutes the nervous fluid" — Philip's experiments showed that by the Galvanic influence digestion proceeded tho' the nerves of the stomach were divided — that the disordered functions of respiration were relieved — that the death of the blood was retarded — and that the nervous fluid [illegible] converted that a nervous conductor [illegible] and thus perform its functions! — [illegible] can be [illegible] of the [illegible] of the nervous fluid!

Mr Earle repeated & confirmed these experiments — Mr Brodie denies the dependence of secretion upon the nerves but it seems probable that he allowed the ends of the divided nerves to remain in contact, or near each other with a fluid intervening, which is sufficient to transmit the [illegible] influence.

Humboldt has shown that a ligature upon a nerve

ments the galvanic action — Hence ulcerated al-
bumen from the blood by this agent.
M. Eagle [illegible] in a case in the [illegible] of [illegible]
in [illegible] mentions that has obtained a case where
the temperature of a paralyzed limb was raised from
71° to 77° by the application of electricity.
[illegible] has already applied this agent to in-
numerable medical purposes and a late paper announces
that Magendie has cured a ulcerated [illegible]
by connecting the [illegible] of the [illegible] in a galvanic circle
[illegible] received [illegible] the idea of [illegible] the
[illegible] and [illegible] a [illegible] — [illegible] the [illegible]
of galvanism [illegible] in the [illegible] of [illegible]
[illegible] by the phenomena of the [illegible]
[illegible] — [illegible] they [illegible] the agent [illegible]
the [illegible] it is remarkable that
the nerves connected with the electrical organ [illegible]
[illegible] to [illegible] other [illegible] — the [illegible] of [illegible]
These facts are [illegible] the evidences of

the two principles express — We know that the [illegible] of galvanic fluid is [illegible] two alterna-tive [illegible] in the [illegible] [illegible] of the smallest and most magnificent acts — at one moment rending the "gnarled and unwedgeable oak" — at another, uniting the elements of the simple rain drop. — Its source is boundless — its energy ceaseless.

With regard to the offices of the nerves in dis-tinction we can say but little. — We shall not ex-amine the stated experiments of Bichat, in which he attempts to prove that the olfactory and other nerves are not essential to [illegible], [illegible] of seeing & smelling, but that these depend on the 5th pair — not only many observations disprove this, but there were too many sources of error in these ex-periments to allow of any deduction from them. In man the senses are five, but in other animals there may be more. [illegible] [illegible] [illegible] [illegible] [illegible] the in-

sentient nerves appreciate only their appropriate stimuli. - ~~[illegible]~~ Magendie lately mentioned that he had irritated the retina without exciting any perception of pain and taste was impaired when ordinary sensibility was lost - In the eye and ear there is a peculiar mechanism to modify the impression agent, but in the organs of taste, the parts are so arranged as to allow the greatest expansion to the nerves.

The cause of sensation has been attributed first to the vibration of the nerves - secondly - to the motions of a particular fluid - This last opinion has been ingeniously supported by Crichton in his work on Insanity. He supposes that this fluid has its particles at various distances, and that by impressions, a certain arrangement of particles may be propagated thro all the nerves to the brain - hence the brain has sensation impression & this sensorial impression - Another opinion is that of Darwin - He supposed that the nerves have powers of contraction like to those of a muscle, and that by the various exercise of this power, all the phenomena of sensa-

tions are produced. — We must reject all these opinions, for in no way do they correspond with the sensible qualities of the nerves. We could challenge their advocates to show how the vibration of a chord, the motion of a fluid or the contraction of a fibre could produce any distinction of effect except what might arise from a difference in the degree of force — It is only in the varied operations of the material vital principle that we can discover an explanation — For so it seems to us to warrant that this is the percipient principle. We only know that they are generated in this agent by the impression of material substances; the immaterial essence, which we call mind, becomes conscious of external objects, and an idea or sensation is the consequence — This animal fluid is the instrument of the soul and is a mysterious connexion mediately between it and the material world.

It is only by a change of action, or alteration of nature, some little resembling the increase in irritability of a mechanical cause, that we can account for the va-

city and compass of our sensations – But lest it should be said that no qualities of any material agent would be equal to this effect, it should be understood that our sensations are compound, and made up of certain sensations comparatively few in number – The theory of sounds illustrates this remark – The senses do not originally acquire the perception of external objects by causing sensation, but their sensations, instantaneously upon that stroke, occasion the production of sensation – Thus a blow on the eye, or undigested matter will for the time darken the appearance of sparkles, and the electricity of galvanic action by means of the tongue and different metals will give the idea of a flash of light to the superincumbent, but not to a bystander – Sounds in the ear, and the eye will sometimes involuntarily see colours – These phenomena are generally attributed to the imagination, but incorrectly. In its creations can be supposed or contrived, but these spontaneous sensations cannot

They doubtless arise from an action in the brain

a nerve, imitation of that, the results of their natural excitants. We cannot demonstrate the materiality of the ~~the~~ nervous principle of the senses as of other organs but there are many analogies to prove that it is also the creation of an organic action — Thus it is soon ~~limited~~ exhausted by exercise — it is renovated by rest, and is accumulated by immediate vascular action.

The improvement of the senses by exercise has been urged against the materiality of the instinct principle, for how it is said can a physical effect be heightened by simply ~~reiterated~~ operations — We deny that the organs of sense are ever improved — Thus a distant object may seem obscure, but being informed of its nature we immediately recognize it, and it appears more distinct than before: here the vision is not increased, but the attention being directed the mind observes features not before noticed — and this will account for the refinement of the ear, tongue & smell.

We now come to the other important function of

the nerves — that of motion — and as to the excitation of this: Junctions, the brain, the nerves and the muscles are unquestionably (in their natural state) connected: it is difficult to discriminate the duties of each — The complete chain of muscular contraction upon the principle of animal irritability, it is [illegible] was the chief [illegible] Willis opinion, since — Haller supposed that this was a peculiar principle distinct from nervous energy, and in proof of this showed many experiments and adduced innumerable facts — Animals thought to want nerves were found to irritate — their irritability remained after death, or in a muscle separated from the body — the irritability of motion of a part (supposed to depend upon the same nerves) did not appear to be suspended always — and to prove that irritability might be a property of fibre, the contraction of certain plants as the mimosa pudica & venus fly trap by stimuli were adduced — The chief error in Haller's theory seem to arise from the supposing the identity of the nerves of sensation and of motion, and

that the brain was the sole seat of nervous power — tho'
generally accredited this theory met with many staunch
and mighty opinions. and has met with a still more
conscious opposition in the arguments of [illegible]
[illegible] and others — Against Haller's theory have been ur-
ged the insensibility of the heart to the stimulus, the [illegible]
that its action is not proportionate to the quantity of
blood in it: that its action becomes more frequent after
the loss of a considerable quantity of blood, and that it even
continues to act when empty. These and many other
facts tend to subvert Haller's theory: and surely it is
more philosophical to attribute the regular action of
the stomach, the stated contraction of the womb and of the
organs to some uniform impression of the nerves, rather
than to the simple irritation of ~~their~~ various contents.
By this theory the gall bladder and the [illegible] [illegible]
stimulated by their appropriate fluids in the [illegible]
[illegible] [illegible] may take place at certain periods — then
are we to suppose that these fluids - the bile & semen are

able to suspend their action without the proper occupancies [illegible] point — they are present in their cavities, but no determinants, and if the theory be true, we have here a cause without an effect — The same reasoning will equally apply to the function of the nerves — The support of [illegible] the sensibility of the nerves of the heart (and some denied that it had any) was [illegible]; but to this we reply that the nervous energy of an organ depends upon its supply of blood and of nerves conjointly — Now in the heart there is a more rapid succession of highly aerated blood than in any other part and in this way may we account for the energy of that organ.

The experiments of Dr. Walters have gone far to show the relation the heart bears to the brain and spinal marrow. I shall not enumerate them — It is sufficient to say that their accuracy has been tested by the late Prof. of Medicine in this University who has also drawn ~~some~~ some important physiological principles from the results they describe.

Many prove that [illegible]

From any part of the spinal marrow, situated ~~between~~ between
of the sympathetic nerve, whose object is to lay under
contribution all the parts whence it arises — As the
heart then is not dependent upon the brain it was, to
apply to them in what manner its destruction proves
fatal, and this he has done by proving that it is from
asphyxia, which is the effect of the removal of that part of
the medulla oblongata, whence the respiratory nerves
arise — As the irritability of any part depends upon the in-
tensity of the circulation, and of that part of the medulla
spinalis whence it arises, it follows that large por-
tions of the medulla may be destroyed, without annihi-
lating the action of the heart, and this possible by limiting the circulation, to retain life in any
insulated portion of an animal — Thus the thorax alone
may live, if the power of the heart be there concentra-
ted by putting ligatures on the carotids and abdominal
aorta and then immediately the head and all the inferior
parts — Le Gallois also shews that the voluntary muscles

arise from pieces [illegible] from the medulla spinalis, but that this ~~[illegible]~~ direction depends upon an influence derived from the brain — thus a division of the spinal marrow will create two nervous centres, each capable of producing motion but not in concert — Dr Philip was [illegible] of the conclusions of Le Gallois — He contends that the sensitory and involuntary muscles are both independent of the nervous system but that the former are [illegible] the other [illegible] [illegible] in [illegible] — [illegible] the point that Le Gallois attempted to [illegible] was not whether any [illegible] substitute could be found in the nervous [illegible] but whether in the animal economy this was the natural and only agent of muscular contraction — Philip does not discriminate between the irritability of the muscular fibre and its reactive and natural contraction — In case 139 of his Enquiry he says — "When both [illegible] the Brain [illegible] were removed the peristaltic motion of the intestines remained unaffected. [illegible] [illegible] [illegible] [illegible] [illegible], so that when the intestines [illegible] to the [illegible]

[illegible] their pieces, but if these [illegible] there remained — Here upon the atmosphere as much as the lungs [illegible] were exposed are the pieces more exposed than the others of their stratum did not depend more upon the air — And yet he concludes from this that the intestines are entirely independent of the nerves —

He found that [illegible] affected the heart by being applied to any part of the brain [illegible] manner, [illegible] the muscles of [illegible] motion [illegible] when it acted upon the immediate source of their nerves — This would corroborate the opinion that the involuntary muscles receive their influence from all parts of the central system — He found that [illegible] necessary to the power of contraction in all the muscles, it then must be some peculiar quality in the muscular fibre itself in relation to [illegible], [illegible] found that the [illegible] when the part is separated from the body — [illegible] and many other writers attribute it to the mechanism of the muscular fibre [illegible] — Others to an inherent quality — [illegible] an [illegible] quality not [illegible] [illegible] [illegible] [illegible]

ied are in particular cases completely exhausted.—

We believe it to be the result of a nervous action upon the blood or vessels; in cases of destruction — or paralysis, tho' the power of the will be lost over the muscles, & their irritability remains, but this does not more militate against our opinion, than it does against that which derives our temperature from a nervous action — It only proves the nerves of secretion to be different from those of motion — The energy of muscular contraction is generally proportioned to the energy of nutrition, and a thickness of muscle indicative of strong powers of nutrition — Depriving a limb of blood renders its muscles inoperative, and increasing the quantity gives increased energy — It is also observed that the integrity of the veins is necessary to the functions of the muscles. During exercise an increase of arterial action is safely endured ~~that~~ which in a state of rest would prove highly injurious — We cannot suppose that the respiration is the only means of modifying this state of the circulation, as this is entirely too partial and local in its operation — We are led to believe that the action of the muscles requires and consumes the additional

[illegible] of the [illegible] principle, and thus prevents the [illegible] of excess. — This is true would serve the beautiful economy of the nature, since the increased energy of the muscle action would be [illegible] to answer an important design and not to be the unavoidable effect of the mechanism. — From these considerations we become [illegible] to [illegible] the effect of the [illegible] and nervous action, and that a quantity bestowed [illegible] [illegible] [illegible]. — There would be the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] increases [illegible] the attraction of each other — That the [illegible] [illegible] [illegible] particles of [illegible] approximation of [illegible] & that an influence derived from [illegible] increases the attraction [illegible] and causes [illegible] [illegible] and [illegible] [illegible]. — [illegible] [illegible] [illegible] [illegible] the effects of oxygen, [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] that [illegible] [illegible] [illegible] under the [illegible] of nervous action and [illegible] [illegible] causes, [illegible]

[illegible] it demonstrated that they contain a principle of attraction and that this attraction [illegible] [illegible] increase of the [illegible] whether this principle be a material one or the effects of an unknown and inconceivable ~~principle~~ [illegible], we have [illegible] endeavoured to [illegible].

The power of [illegible] [illegible] to [illegible] in the abstract the limit of this attraction [illegible] that [illegible] one of the [illegible] laws of attraction.

We have thus [illegible] to conclude [illegible] which have been [illegible] to [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]